**Before the**
**Federal Communications Commission**
**Washington, DC 20554**

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| In the Matter of | ) | |
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| Improving Public Safety Communications in the 800 MHz Band | ) | WT Docket No. 02-55 |
| | ) | |
| | ) | |
| Consolidating the 900 MHz Industrial/Land Transportation and Business Pool Channels | ) | |
| | ) | |

To: The Commission

# JOINT COMMENTS OF CINGULAR WIRELESS LLC AND ALLTEL COMMUNICATIONS, INC.


Glenn S. Rabin
ALLTEL Communications, Inc.
601 Pennsylvania Avenue, NW
Suite 720
Washington, DC 20004

*Its Attorney*

J. R. Carbonell
Carol L. Tacker
David G. Richards
Cingular Wireless LLC
5565 Glenridge Connector
Suite 1700
Atlanta, GA 30342

*Its Attorneys*


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## SUMMARY

The 800 MHz restructuring proposals summarized in the *Notice*, while containing some positive aspects, are insufficient to meet the *Notice*'s goals of (i) eliminating interference to public safety systems, (ii) assuring sufficient spectrum for critical operations, and (iii) minimizing disruption to the existing license structure in the band. Accordingly, the Joint Commenters strongly support the alternate *Coalition Proposal* put forth by the Coalition for Constructive Public Safety Solutions, which represents the interests of both small and large CMRS providers and manufacturing and private radio enterprises.

As a preliminary matter, the Joint Commenters disagree with the *Notice*'s blanket characterization of "cellularized CMRS systems" as the cause of severe interference to public safety communications. APCO's *Project 39* report relied upon in the *Notice* documents few cellular sites as sources of interference to public safety. To the contrary, *Project 39* indicates that "ESMR sites operated by Nextel or other ESMR operators seem to be the most commonly identified contributing factor" to interference to public safety operations. The Joint Commenters' own experiences as cellular licensees bear this out.

The Joint Commenters agree with the *Notice*'s assessment that "no one restructuring candidate appears fully able to meet our goal of reducing or eliminating interference without burdening existing licensees." The *Nextel Proposal* in particular fails to meet the Commission's goals. If adopted, there would still be receiver overload, intermodulation products would still be generated, and out-of-band emissions would be improved only marginally. Nextel's plan would require virtually all licensees in the 800 MHz band to relocate at their own expense, with the exception of Nextel's contingent (all-or-nothing) $500 million contribution towards public safety relocation. Nextel's suggestion that other 800 MHz CMRS providers help fund public safety relocation costs cannot be sustained, because Nextel is the cause of interference in most instances.

Based on available information, the *Nextel Proposal* disproportionately benefits Nextel. Nextel's proposal would give ESMR (for the most part, Nextel) 16 MHz of nationwide contiguous spectrum in the 800 MHz band and an additional 10 MHz of nationwide contiguous spectrum in the 2.1 GHz MSS band. In return, Nextel would relinquish 4 MHz of non-nationwide spectrum in both the 700 MHz and 900 MHz bands and unspecified spectrum holdings in the 800 MHz band. Such a disproportionate exchange is contrary to Section 309(j) of the Communications Act and the Commission's long-standing policy of not favoring individual competitors.

Nextel's proposal to obtain 10 MHz of nationwide contiguous spectrum at 2.1 GHz is disingenuous. The spectrum is being considered in other proceedings as a solution to critical spectrum needs for advanced wireless services, including 3G systems. Moreover, the purported *quid pro quo* for the 2.1 GHz spectrum is Nextel's surrender of a limited amount of spectrum at 700 MHz and 900 MHz to B/ILT licensees. Yet, there does not appear to be an interference basis requiring the relocation of the B/ILT licensees. Thus, the only apparent reason to propose moving B/ILT is to bolster Nextel's unwarranted grab of 2.1 GHz spectrum for its exclusive use.

The answer to how to improve public safety communications, while minimizing disruption to existing licensees, lies in the *Coalition Proposal*. In essence, the *Coalition Proposal* advocates relocating public safety from the 800 MHz band to the 700 MHz band, which requires a delay in the 700 MHz auctions (Auction Nos. 31 and 44), and auctioning vacated 800 MHz spectrum to help pay for relocation of public safety. Highlights of the *Coalition Proposal* are to:

- Reallocate all of the upper 700 MHz band (UHF-TV channels 60-69) to public safety, with the exception of already auctioned guard band spectrum.
- Use some of this additional spectrum for Homeland Security, Priority Access Service, and/or critical infrastructure needs depending upon what the Government determines is the best use.
- Move 800 MHz public safety licensees to 700 MHz.
- Auction vacated 800 MHz public safety spectrum.
- Use auction revenues to help relocate public safety to 700 MHz and fund new equipment.
- Work with Congress to enact legislation (i) reallocating 30 MHz of spectrum currently allocated for commercial use to public safety (excludes 6 MHz of guard band spectrum already auctioned); (ii) targeting auction revenues to help fund public safety relocation; and (iii) requiring broadcasters to exit the upper 700 MHz band by December 31, 2006 or sooner.

This proposal, if fully implemented, provides numerous benefits. For public safety licensees, interference will be resolved; they will gain 30 MHz of additional spectrum nationwide (20.5 MHz net); they will have a date certain for access to 700 MHz band spectrum; auction proceeds will help fund relocation and equipment upgrades; and public safety interoperability, priority access services and other homeland security needs will be facilitated. For conventional SMR and B/ILT licensees, there will be no relocation or relocation costs, and they will gain access to additional spectrum contiguous to their current spectrum assignments. For Nextel, interference with public safety will be eliminated, relocation costs (compared to its plan) will be reduced, and it can bid for additional spectrum. Finally, cellular licensees will be able to compete at auction for additional contiguous spectrum.

The *Coalition Proposal* is the most viable solution for dealing with interference to public safety on a long-term basis and it prevents the need to continually revisit this issue. The proposal does require congressional action. However, the benefits of such action will be significant to the public interest, especially public safety. Accordingly, Commission postponement of the 700 MHz auctions is warranted so that this proposal can be explored and implemented.

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**JOINT COMMENTS OF CINGULAR WIRELESS LLC AND ALLTEL COMMUNICATIONS, INC.**

Cingular Wireless LLC ("Cingular") and ALLTEL Communications, Inc. ("ALLTEL") (collectively, "Joint Commenters") hereby submit these comments in response to the Commission's *Notice of Proposed Rulemaking* in this proceeding.[1] The Joint Commenters address the causes of and proposed solutions to interference to public safety operations in the 800 MHz band. As discussed herein, the 800 MHz restructuring proposals summarized in the *Notice*, while containing some positive aspects, are insufficient to meet the *Notice*'s goals of (i) eliminating interference to public safety systems, (ii) assuring sufficient spectrum for critical operations, and (iii) minimizing disruption to the existing license structure in the band. Accordingly, the Joint Commenters strongly support the alternate plan put forth by the Coalition for Constructive Public Safety Solutions ("Coalition") and described in Section III below as the best means of achieving the *Notice*'s goals.

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[1] *See Improving Public Safety Communications in the 800 MHz Band*, WT Docket No. 02-55, *Notice of Proposed Rulemaking*, FCC 02-81 (rel. Mar. 15, 2002) ("*Notice*"), *summarized*, 67 Fed. Reg. 16351 (Apr. 5, 2002).

## I. INTERFERENCE TO PUBLIC SAFETY SYSTEMS

### A. Sources of Interference

As a preliminary matter, the Joint Commenters disagree with the *Notice*'s blanket characterization of "cellularized CMRS systems" as the cause of severe interference to public safety communications.[2] While CMRS users of the 800 MHz band include both "enhanced" SMR (*e.g.*, Nextel) and cellular radiotelephone licensees, current evidence indicates that a significant majority of interference to public safety users is caused by Nextel's ESMR operations. For example, the *Notice* relies upon APCO's *Project 39* report, which documented interference encountered in various states throughout the country. *Project 39* cases represent less than 1% of all CMRS sites nationwide, however, and most of these sites are Nextel sites. Few cellular sites are documented as sources of interference to public safety.[3] As *Project 39* indicates, "ESMR sites operated by Nextel or other ESMR operators seem to be the most commonly identified contributing factor" to interference to public safety operations.[4]

Cingular's own experience as a cellular licensee is consistent with the *Project 39* data indicating that cellular providers are rarely the cause of interference to public safety providers. As a national carrier, Cingular's cellular sites have been identified as a potential source of

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[2] *See, e.g., Notice* at ¶ 14.

[3] *See generally Project 39, Interference to Public Safety 800 MHz Radio Systems, Interim Report to the FCC*, Dec. 24, 2001 ("*Project 39*"), available at <http://www.apcointl.org>. For example, the attached technical discussion, prepared by a working group of engineers from several major cellular and digital SMR operators, reports that working group companies have experienced only "isolated reported cases of interference into public safety systems." *See* "800 MHz Interference Mitigation: Technical Discussion," at § 2 (May 6, 2002) ("Technical Discussion," appended hereto as Attachment A).

[4] *Id.*, Interim Status Report of the Project 39 Technical Committee at 3; *see also* Technical Discussion at § 2.

interference in only 5 markets across the country. In 3 of the 5 markets, the public safety agencies were unaware of any interference concerns related to Cingular when contacted by Cingular representatives. In a fourth market, the source of interference was identified and found by Cingular personnel to be Indiana Department of Transportation surveying equipment. Finally, in Anne Arundel County, Maryland, Cingular has been working with the county to mitigate interference identified by the county.[5] In this market, the interference is believed to be primarily due to public safety receiver overload and, to a lesser extent, intermodulation with Nextel frequencies, both of which are discussed below.

Similarly, ALLTEL's cellular sites have been identified as a possible source of interference in only 6 markets. In one market, ALLTEL was determined not to be the cause of the interference, and in another the problem has been resolved by voluntary efforts on the part of ALLTEL. In a third market, the problem has been identified as a weak public safety signal. In a fourth market, ALLTEL has been unable to find a contact name to determine the actual area of problem, and is awaiting information from the local public safety group. In the remaining two markets, Phoenix, AZ and El Paso, TX, ALLTEL is actively working with Nextel and the local public safety body to find resolution to the cases.

### B. Causes of Interference

Citing to the *Best Practices Guide* – a document dealing with reducing interference to 800 MHz public safety systems – the *Notice* identifies several potential causes of interference to

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[5] Cingular will continue to assist the county with its efforts to resolve radio interference situations as they arise. Nevertheless, it should be noted that there is an ongoing matter before the Commission concerning the limits of the county's jurisdiction to regulate radio frequency interference. *See* Federal Preemption of Anne Arundel County Ordinance Regulating Radio Frequency Interference, Petition for Declaratory Ruling (filed Apr. 23, 2002).

public safety systems, including receiver overload, intermodulation and transmitter sideband noise.[6] Each of these causes is discussed below in order of frequency of occurrence and in more detail in the attached Technical Discussion.[7]

*Receiver Overload*. The first stage of most receivers is an amplifier, which is designed to enhance the desired signal for use by the rest of the receiver. Because this device also amplifies other (undesired) signals close to the same frequency, receiver overload occurs when the undesired signal(s) overload the amplifier.[8] Receiver overload is the major cause of interference to public safety systems because public safety radios are designed to have a wide front end due to the broad range of frequencies that have been allocated to public safety. As such, they "see" a lot of frequencies outside of those assigned to them, such as ESMR, and, to a much more limited extent at the upper end, cellular.[9] As the Commission stated in the *Notice*, "public safety receivers are often not sufficiently selective to reject undesired signals."[10]

For example, public safety licensees have a total of 9.5 MHz of spectrum in the 800 MHz band – 4.75 MHz of uplink spectrum and 4.75 MHz of downlink spectrum – but no more than 3 MHz is contiguous within any segment. While public safety has spectrum interleaved

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[6] *See Notice* at ¶ 15 (citing *Avoiding Interference Between Public Safety Wireless Communications Systems and Commercial Wireless Communications Systems at 800 MHz – A Best Practices Guide*, Dec. 2000 ("*Best Practices Guide*"), available at <http://wireless.fcc.gov/publicsafety>).

[7] *See* Technical Discussion at § 2.2.

[8] *See Best Practices Guide* at 8-9.

[9] In addition, at the edge of the spectrum designated for public safety, the public safety radio front end filter's roll-off is very gradual. *See* Technical Discussion at § 2.1.1.

[10] *Notice* at ¶ 15.

throughout the 809.75-816.00/854.75-861.00 MHz bands (uplink/downlink), alternating spectrum segments are licensed to SMR and Business and Industrial/Land Transportation ("B/ILT") users. SMR licensees also operate on either side of this interleaved spectrum. Although public safety also has 3 MHz of uplink spectrum at 821-824/866-869 MHz, the low end of this spectrum is immediately adjacent to SMR spectrum at 816-821/861-866 MHz. The high end is adjacent to cellular frequencies. Public safety radios may also use channels in the 806.00-809.75/851.00-854.75 MHz portion of the band by swapping channels with SMR providers. Thus, public safety radios designed to capture all possible uplink frequencies between 806-824/851-869 MHz and will also pick up non-public safety frequencies, especially SMR.[11] These allocations are described in the following table:

Mobile and Control Station Transmit Frequencies

| 806 MHz | | 809.75 MHz | 816 MHz | 821 MHz | 824 MHz |
|---|---|---|---|---|---|
| Public Safety (700 MHz band) | General Category (Channels 1-150) | 250 Interleaved 25 kHz channels – Public Safety (70) [1.75 MHz];Industrial/Land Transportation (50) [1.25 MHz]; Business (50) [1.25 MHz]; SMR (80) [2 MHz] | Upper 200 SMR (Channels 401-600) | NPSPAC Public Safety channels (230 25 kHz channels) | Cellular (A&B) |
| 851 MHz | | 854.75 MHz | 861 MHz | 866 MHz | 869 MHz |

Base Station Transmit Frequencies

*Intermodulation*. Intermodulation occurs whenever two or more different transmitted frequencies become mixed, either at the transmitter, in the receiver, or in an external object. The mixing process generates new, unwanted frequencies. The undesired signals are produced by

[11] *See generally Best Practices Guide* at 5; *Notice* at ¶¶ 6-9; Technical Discussion at § 2.1.2.

various sums and differences of combinations of the desired frequencies.[12] In the case of public safety interference, the undesired intermodulation products are produced inside the public safety receivers. As with receiver overload, the wide front end design of the public safety radios, combined with limitations of the low noise amplifier, are responsible for the generation of the undesired intermodulation products. Intermodulation is exacerbated when multiple strong transmissions are received, such as in the vicinity of a tower with multiple co-located service providers.

*Transmitter Sideband Noise*. All transmitters produce energy outside of their intended transmit channel as a result of the modulation process. Such out-of-band emissions are permissible as long as they fall within specified FCC emission masks.[13] When the out-of-band emissions are received by a nearby receiver, they contribute to the noise level within that receiver. Because out-of-band emissions from CMRS transmitters are much lower in strength than their in-band emissions, out-of-band emissions are only a potential source of interference when the receiver is very close to the CMRS transmit site, or if the receiver is receiving a very weak signal from its associated base station. In the former scenario, interference due to overload will be predominant, and out-of-band emissions are only a small contribution to the interference environment. In the later scenario, the interference is the result of the public safety system

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[12] *See Best Practices Guide* at 8; *see also* Technical Discussion at § 2.2. For example, according to the *Best Practices Guide*, "a portable receiver attempting to receive on the frequency 869 MHz could potentially receive intermodulation interference from cellular transmissions occurring at 870 MHz, 871 MHz and 872 MHz (870+871-872 = 869 MHz)." *See Best Practices Guide* at 8.

[13] *See Best Practices Guide* at 9 (citing 47 C.F.R. § 90.235(b)).

architecture, in which only one or a few base stations are used to cover a very large geographic area.

In sum, interference to public safety systems in the 800 MHz band has three main causes. First, the design of public safety receivers to have a wide front end allows them to "see" frequencies outside of those assigned to them and makes them more susceptible to receiver overload and intermodulation interference. Second, the design of the public safety system to use a single or a few high-power sites with a progressively weaker signal away from the base station creates the situation where the public safety weak signal area encloses low power multi-site commercial systems; public safety systems were designed with the expectation that there would be few nearby spectrum users. Finally, the public safety band plan, in which public safety frequencies are interleaved with and in spectral proximity to ESMR systems, and to a much lesser extent cellular systems, encourages intersystem interference.

### C. Eliminating/Mitigating Interference

Understanding the sources and root causes of interference to public safety systems is essential in determining how to mitigate interference. In light of the foregoing, receiver overload can be primarily reduced by deploying public safety receivers that are more discriminating in the signals they pick up, and to a lesser extent through frequency and geographic distance separation between public safety and commercial operations. Intermodulation can be reduced by spectral separation if the separation takes advantage of the rejection capabilities of the receiver front end filter to attenuate one or both of the signals being mixed.[14] It can also be mitigated to a certain

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[14] In other words, as with receiver overload, narrower public safety receiver front ends would not only reduce the out of band signals, they would also reduce the potential for intermodulation. Additional dynamic range of the public safety receiver, *i.e.*, the ability of the radio to handle both weak and strong signals, would greatly improve the performance in this
(continued on next page)

extent by isolating the potential interferor so that intermodulation products can only be generated from one source and not a mixing of different carrier's frequencies. Finally, transmitter sideband noise can best be limited by spectral separation because the sideband noise generally falls off with frequency separation.[15]

No broad-brushed "complementary measures," such as those proposed in the *Notice* to limit CMRS signal strength or reduce already appropriate out-of-band emission limits, should be imposed.[16] Cellular carriers have not been shown to be a major cause of interference. Such measures would degrade service and significantly impair the ability of cellular subscribers to receive a sufficiently reliable signal.

As discussed in Section III below, the proposal of the Coalition addresses many of the root causes of public safety interference by providing for (i) spectral separation between public safety and commercial users, and (ii) a mechanism to fund upgrades to public safety receivers as part of relocation expenses.

## II. ANALYSIS OF RESTRUCTURING PROPOSALS

The *Notice* "solicit[s] proposals on how best to remedy interference to 800 MHz public safety systems consistent with minimum disruption to our existing licensing structure and assurance of sufficient spectrum for critical public safety communications."[17] Consistent with

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category. Both of these modifications, however, may be limited by the capabilities of existing radios and may require upgrades.

[15] Transmit filters can be deployed to reduce out of band sideband noise, but their use degrades system performance and they are quite expensive to deploy, especially on a system-wide basis.

[16] *See Notice* at ¶¶ 75, 77.

[17] *Notice* at ¶ 2.

these goals, the technical paper attached hereto as Attachment A analyzes in detail the three proposals to restructure the 800 MHz band listed in the *Notice*, including the proposals by Nextel Communications, Inc. ("Nextel"), the National Association of Manufacturers ("NAM"), and the FCC.[18]

In general, each of the 800 MHz band restructuring options proposed in the *Notice* appears to eliminate public safety interleaving by consolidating public safety toward one end of the band, generally the lower end of the 800 MHz band. The proposals which separate ESMR from public safety will see an improvement in out-of-band emission interference. The Joint Commenters agree, however, with the *Notice*'s assessment that "no one restructuring candidate appears fully able to meet our goal of reducing or eliminating interference without burdening existing licensees."[19] For example, receiver overload will not be mitigated at all with any of these proposals, and intermodulation will only be marginally improved.

**A. Nextel Proposal**

Under the *Nextel Proposal,* two separate but adjacent contiguous channel blocks would be created in the 800 MHz band. The upper 16 MHz block would be reserved for ESMR at 816-824 MHz and 861-869 MHz.[20] The lower 20 MHz block at 806-816 MHz and 851-861 MHz would be reserved for public safety, although the need for a guard band on the downlink between

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[18] *See Notice* at ¶¶ 23-25 (summarizing Promoting Public Safety Communications; Realigning the 800 MHz Land Mobile Radio Band to Rectify Commercial Mobile Radio – Public Safety Interference and Allocate Additional Spectrum to Meet Critical Public Safety Needs (Nov. 21, 2001) ("*Nextel Proposal*")); *Notice* at ¶¶ 21-22 (summarizing Letter from Jerry Jasinowski, President, NAM and Clyde Morrow, Sr., President, MRFAC, Inc. to Michael Powell, Chairman, FCC (Dec. 21, 2001) ("*NAM Proposal*")); *Notice* at ¶ 26 ("*FCC Proposal*").

[19] *Notice* at ¶ 20.

[20] *Notice* at ¶ 23.

ESMR and public safety may reduce the proposed block to 18 MHz or less.[21] As a result, although Nextel states that public safety would realize a net spectrum gain of 10.5 MHz (in addition to the current 9.5 MHz allocated in the 800 MHz band) under its plan, the true amount is likely to be 8.5 MHz or less due to the need for a guard band.

The *Nextel Proposal* would require significant relocation by existing public safety and non-public safety 800 MHz licensees both within and out of the 800 MHz band. With respect to relocated public safety licensees, Nextel proposes to contribute up to $500 million to help defer their relocation costs. Nextel argues that SMR, B/ILT, and 800 MHz cellular licensees, as well as public safety licensees themselves, should pay the additional cost of relocating 800 MHz public safety stations.[22] Nextel's $500 million contribution, however, is contingent upon adoption of all elements of its band plan, including the reallocation to Nextel of nationwide licenses for a contiguous 10 MHz block of spectrum currently allocated and licensed to MSS at 2 GHz.[23] Non-public safety licensees, *e.g.*, conventional SMR and B/ILT licensees, would be forced to accept secondary status or to relocate *at their own expense* to spectrum surrendered by Nextel in the 700 and 900 MHz bands.[24]

As discussed below, Nextel's proposal fails to satisfy the *Notice*'s goals.

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[21] *Notice* at ¶ 23 & n.51.

[22] *Notice* at ¶ 38.

[23] *Notice* at ¶ 39 n.107.

[24] *Notice* at ¶ 35. Nextel proposes to surrender its 900 MHz SMR licenses (4 MHz) and the 700 MHz guard band Block B spectrum it acquired at auction (4 MHz) for use by these displaced licensees. *Id.*; *Nextel Proposal* at 7.

### 1. Nextel's Proposal Is an Attempt to Exchange Less Useful Spectrum for More Valuable Contiguous Nationwide Licenses without Competing at Auction

Based on available information, the *Nextel Proposal* disproportionately benefits Nextel. Nextel's proposal would give ESMR (for the most part, Nextel) 16 MHz of nationwide contiguous spectrum in the 800 MHz band and an additional 10 MHz of nationwide contiguous spectrum in the 2.1 GHz MSS band. In return, Nextel would relinquish 4 MHz of non-nationwide spectrum in both the 700 MHz and 900 MHz bands and unspecified spectrum holdings in the 800 MHz band.

Nextel has been asked for information concerning how much spectrum it currently holds and where, particularly in the 800 MHz band, but Nextel has not been forthcoming with this information. In the spectrum aggregation proceeding (WT Docket No. 01-14), however, the Wireless Bureau submitted an HHI analysis of the most populous MSAs and a random sampling of RSAs, along with the spectrum holdings of companies in these markets. By the Commission's reckoning, Nextel's spectrum holdings in the 50 most populous MSAs ranged from 4.25 MHz in Rochester, NY to 14.78 MHz in Oklahoma City, OK, with average holdings around 11 MHz.[25] In the rural markets listed, Nextel had *no* spectrum holdings. Absent specifics from Nextel and its partners as to their current spectrum holdings, its proposal is an attempt to give up less valuable, non-nationwide spectrum holdings for consolidated nationwide licenses – certainly not a one-for-one relationship.

Such a result is contrary to Section 309(j) of the Communications Act, which mandates, with certain exceptions, that the Commission grant initial licenses for mutually exclusive

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[25] *See 2000 Biennial Regulatory Review – Spectrum Aggregation Limits for CMRS*, WT Docket No. 01-14, Information Request for HHI Supporting Analysis (Jan. 18, 2002).

applications through competitive bidding.[26] While Nextel states it would not be applying for "initial licenses" under Section 309(j)(1) but would "merely receive licenses for replacement spectrum in exchange for the spectrum licenses . . . surrender[ed] as part of the realignment plan,"[27] its proposal calls for more than channel swaps. It would receive improved contiguous nationwide spectrum rights. Under any other scenario, Nextel would have to bid for such valuable spectrum rights, and there can be no doubt multiple applicants would apply to use the spectrum it seeks. Accordingly, any award to Nextel of the spectrum it seeks without an auction would be contrary to Section 309(j). Such an unwarranted preference to Nextel would also violate the Commission's long-standing policy of not favoring individual competitors.[28]

Nextel's proposal to obtain 10 MHz of nationwide contiguous spectrum at 2.1 GHz is disingenuous. The spectrum is being considered in other proceedings as a solution to critical spectrum needs for advanced wireless services, including 3G systems.[29] Moreover, the purported *quid pro quo* for the 2.1 GHz spectrum is Nextel's surrender of a limited amount of spectrum at 700 MHz and 900 MHz to B/ILT licensees. Yet, there does not appear to be an interference basis requiring the relocation of the B/ILT licensees. That is, while Nextel proposes to relocate conventional SMR and B/ILT licensees off the 800 MHz band at substantial cost, it is these conventional SMR and B/ILT licensees that are more compatible with public safety from

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[26] *See* 47 U.S.C. § 309(j).

[27] *Nextel Proposal* at 54, *quoted in Notice* at ¶ 82.

[28] *See, e.g., Hawaiian Telephone Co. v. FCC*, 498 F.2d 771, 776 (D.C. Cir. 1974).

[29] *See Amendment if the Commission's Rules to Allocate Spectrum Below 3 GHz to Support New Advanced Wireless Services, Including Third Generation Wireless Systems*, ET Docket No. 00-258, *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, FCC 01-224 (rel Aug. 20, 2001).

an interference standpoint – not Nextel.[30] Thus, the only apparent reason to propose moving B/ILT to the 700 MHz guard band and the 900 MHz band spectrum is to bolster Nextel's unwarranted grab of 2.1 GHz spectrum for its exclusive use.[31]

### 2. Nextel's Proposal Would Not Solve Interference to Public Safety and Is Contrary to the Goal of Minimizing Disruption to Existing Licensees.

Nextel's proposal also fails to meet the Commission's goal of resolving interference while minimizing disruption to existing licensees. With respect to interference, there would still be receiver overload, intermodulation products would still be generated, and out-of-band emissions would be improved only marginally.[32] Nextel also greatly underplays the amount of interference its ESMR operations are causing to public safety and significantly overplays the amount of interference other CMRS providers are causing. As discussed in Section I above, current evidence indicates that Nextel is responsible for the majority of cases of interference experienced by public safety, while the incidents of interference caused by other CMRS providers are isolated occurrences. This conclusion is highlighted by the fact that its proposal would require a downlink guard band of 2 MHz or greater to minimize interference between its operations and those of public safety. At the same time, Nextel's plan would require virtually all licensees in the 800 MHz band to relocate – a proposition that some conventional SMR and B/ILT licensees have estimated would "impose billions of dollars of costs on American

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[30] *See, e.g., Notice* at ¶ 22.

[31] *Cf. NAM Proposal*, *Notice* at ¶¶ 21-22 (providing better interference mitigation without moving B/ILT).

[32] *See* Technical Discussion at § 5.3.

businesses" and would be an "unmitigated disaster from an operational and financial standpoint for America's industrial, transportation and utility sectors."[33]

### 3. Nextel's Cost Reimbursement Proposal Is Contrary to the Public Interest and Inconsistent with Case Law Precedent

Nextel's contingent offer of up to $500 million to pay for partial public safety relocation is disproportionate to the total relocation costs that would be required to effectuate its plan, particularly when compared to (i) the benefits to be attained by Nextel, *i.e.*, nationwide contiguous spectrum at a small percentage of the price that the spectrum would bring at auction, and (ii) the fact that Nextel's systems are the major source of public safety interference. Yet Nextel takes its proposal a step further by suggesting that *other* 800 MHz CMRS providers should help fund the public safety relocation costs because they "will be relieved of the burdens of detailed, ongoing coordination requirements, operational limitations and channel use restrictions necessary to safeguard public safety."[34] Such a proposition cannot be sustained because Nextel is the cause of interference to public safety in most instances. Thus, any benefit to other CMRS providers will be only indirect at best. Agencies may not recover from regulated parties costs for benefits inuring to the public generally and not "directly to the benefit of

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[33] Letter from Aeronautical Radio Inc., American Association of Railroads, American Petroleum Institute, Forest Industries Telecommunications, Industrial Telecommunications Association, MRFAC Inc. and United Telecom Council *et al.* to Michael Powell, Chairman, FCC (Dec. 20, 2001), *quoted in Notice* at ¶ 44; *see also Ex Parte* Letter from Nathan Lemmon, Chief Engineer, FedEx Corporate Services to FCC (Apr. 25, 2002) (explaining that the cost related to relocation of B/ILT incumbents to an alternate band "would be a hundred fold").

[34] *Nextel Proposal* at 39-40.

regulated parties," unless Congress has clearly authorized agencies to do so.[35] For the same reasons, the Commission may not implement Nextel's cost reimbursement proposal.

### B. NAM Proposal

Under the *NAM Proposal*, three separate but adjacent contiguous channel blocks would be reserved as follows: (i) 10 MHz for public safety at 806-811 MHz and 851-856 MHz; (ii) 10 MHz for conventional SMR and B/ILT at 811-816 MHz and 856-861 MHz; and (iii) 16 MHz for ESMR (*i.e.*, Nextel) at 816-824 MHz and 861-869 MHz.[36] Although the *NAM Proposal* would locate public safety licensees next to B/ILT licensees, it states that these licensees are more compatible with public safety from an interference standpoint than ESMR systems.[37]

While the *NAM Proposal* would not require any existing licensee to relocate outside the 800 MHz band, it would require relocation by public safety, B/ILT and SMR licensees within the band.[38] As discussed in the technical paper, adoption of this plan would provide for marginal mitigation of intermodulation interference and side band noise to public safety and no improvement in receiver overload.[39] The *NAM Proposal* would require these licensees, including public safety, to pay for their own retuning and other relocation costs and provides no source for funds to update public safety receivers to mitigate the sources of interference that

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[35] *Skinner v. Mid American Pipeline*, 490 U.S. 212, 223 (1989); *see also National Cable Television Assn., Inc. v. United States*, 415 U.S. 336, 342-43 (1974); *FPC v. New England Power Co.*, 415 U.S. 345 (1974); *FEA v. Algonquin SNG, Inc.*, 426 U.S. 548, 560 n.10 (1976).

[36] *Notice* at ¶ 21.

[37] *See Notice* at ¶ 22.

[38] *Notice* at ¶ 22.

[39] *See* Technical Discussion at § 5.5.

cannot be solved by spectral reallocation alone. Finally, the *NAM Proposal* increases total public safety spectrum by 0.5 MHz.

### C. FCC Proposal

Under the FCC's proposal, lower 800 MHz public safety licensees in the interleaved bands would be moved to contiguous spectrum at 809.75-811.50 MHz and 854.75-856.50 MHz. They would operate next to B/ILT licensees at 811.50-814.00 MHz and 856.60-859.00 MHz, which would provide a buffer from interfering ESMR systems. However, the current upper 800 MHz public safety allocation at 821-824 MHz and 866-869 MHz would remain unchanged and adjacent to potentially interfering ESMR at 816-821 MHz and 861-866 MHz.[40] Intermodulation interference to public safety would be marginally mitigated while there would be no improvement in receiver overload.[41] Like the *NAM Proposal*, it provides no source for funds to update public safety receivers to mitigate the sources of interference that cannot be solved by spectral reallocation alone. In addition, it provides for no net increase in public safety spectrum allocations.

## III. COALITION PROPOSAL: A BETTER SOLUTION

Any proposal to truly solve interference to public safety systems must:

- Provide public safety licensees with new receivers that have a more narrow front-end and provide better filtering of unwanted signals;
- Consolidate public safety's existing 700 MHz and 800 MHz allocations so that they are contiguous; and
- Spectrally separate public safety from cellular architecture CMRS systems.

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[40] *Notice* at ¶ 20.

[41] *See* Technical Discussion at § 5.4.

At the same time, any solution must minimize disruption to existing licensees. Neither the *Nextel Proposal* nor the *NAM Proposal* accomplishes these prerequisites, nor will any 800 MHz rebanding proposal.

The answer to how to improve public safety communications, while minimizing interference to existing licensees, lies in a concept paper circulated on April 25, 2002, by the Coalition ("*Coalition Proposal*").[42] The Coalition is comprised of organizations representing the interests of both small and large CMRS providers, including Cingular and ALLTEL, as well as manufacturing and private radio enterprises. In essence, the *Coalition Proposal* advocates relocating public safety from the 800 MHz band to the 700 MHz band, which requires a delay in the 700 MHz auctions (Auction Nos. 31 and 44),[43] and auctioning vacated 800 MHz spectrum to help pay for relocation of public safety. Highlights of the *Coalition Proposal* are to:

- Reallocate all of the upper 700 MHz band (UHF-TV channels 60-69) to public safety, with the exception of already auctioned guard band spectrum.[44]

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[42] A copy of that filing is attached hereto as Attachment B.

[43] *See, e.g.,* Letter from Brian Fontes, Vice President, Federal Relations, Cingular Wireless LLC, to Marlene H. Dortch, Secretary, FCC in WT Docket Nos. 99-168 & 02-55 and GN Docket No. 01-74 (May 3, 2002); Cellular Telecommunications & Internet Association, Application for Review, WT Docket No. 99-168 & GN Docket No. 01-74 (filed Apr. 24, 2002); Comments of the National Emergency Number Association in WT Docket No. 99-168 & GN Docket No. 01-74 (May 1, 2002); Letter from Glen Nash, President, Association of Public-Safety Communications Officials International, Inc. to Michael Powell, Chairman, FCC in WT Docket No. 99-168 & GN Docket No. 01-74 (May 2, 2002).

[44] The Commission has reclaimed 60 MHz of upper 700 MHz broadcast spectrum (channels 60-69) and allocated 24 MHz (764-776 MHz and 794-806 MHz) to public safety; 30 MHz (747-762 MHz and 777-792 MHz) to commercial licensees; and 6 MHz to guard bands (746-747 MHz, 776-777 MHz, 762-764 MHz, and 792-794 MHz). *See, e.g., Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules*, WT Docket No. 99-168, *Second Report and Order*, 15 F.C.C.R. 5299, ¶ 9 (2000). The Coalition
(continued on next page)

- Use some of this additional spectrum for Homeland Security, Priority Access Service, and/or critical infrastructure needs depending upon what the Government determines is the best use.

- Move 800 MHz public safety licensees to 700 MHz.

- Auction vacated 800 MHz public safety spectrum.

- Use auction revenues to help relocate public safety to 700 MHz and fund new equipment.

- Work with Congress to enact legislation (i) reallocating 30 MHz of spectrum currently allocated for commercial use to public safety (excludes 6 MHz of guard band spectrum already auctioned); (ii) targeting auction revenues to help fund public safety relocation; and (iii) requiring broadcasters to exit the upper 700 MHz band by December 31, 2006 or sooner.[45]

The *Coalition Proposal* provides several major advantages over the *Nextel Proposal*, the most important of which is the resolution of interference issues with public safety. In addition, the *Coalition Proposal* increases public safety spectrum from the current 33.5 MHz (9.5 MHz in the 800 MHz band and 24 MHz in the 700 MHz band) to 54 MHz (existing 24 MHz of 700 MHz spectrum plus an additional 30 MHz of reallocated from commercial use 700 MHz spectrum). By contrast, the *Nextel Proposal* would increase public safety spectrum at most to 44 MHz (existing 24 MHz of 700 MHz spectrum plus an additional 20 MHz at 800 MHz), though this amount may be lessened by 2 or more MHz due to the likely need for a guard band. The

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Proposal would reallocate to public safety the 30 MHz of commercial spectrum at 747-762 MHz and 777-792 MHz.

[45] This spectrum is currently encumbered by television broadcasters in channels 60-69 who are permitted by statute to continue operations until at least December 31, 2006, at which time their markets are to be converted to digital television ("DTV"). *See* 47 U.S.C. § 337(e); 47 U.S.C. § 309(j)(14). By statute, however, this date may be extended if certain DTV service penetration targets are not met. *See* 47 U.S.C. § 309(j)(14)(B). Legislation would be required to require broadcasters to vacate the band by a date certain, *e.g.*, December 31, 2006 or sooner, without exception.

coincidental switch by public safety to digital technology, such as APCO 25, will further increase effective spectrum capacity and services. Furthermore, existing 800 MHz commercial incumbents and others could gain access to additional spectrum through auction, with auction revenues used to relocate public safety and fund upgrades to public safety equipment.

This concept, if fully implemented, also provides numerous benefits to all licensees in the 800 MHz band. For public safety licensees, interference will be resolved; they will gain 30 MHz of additional spectrum nationwide (20.5 MHz net); they will have a date certain for access to 700 MHz band spectrum; auction proceeds will help fund relocation and equipment upgrades; and public safety interoperability, priority access services and other homeland security needs will be facilitated. For conventional SMR and B/ILT licensees, there will be no relocation or relocation costs, and they will gain access to additional spectrum contiguous to their current spectrum assignments. For Nextel, interference with public safety will be eliminated, relocation costs (compared to its plan) will be reduced, and it can bid for additional spectrum. Finally, cellular licensees will be able to compete at auction for additional contiguous spectrum.

The *Coalition Proposal* is the most viable solution for dealing with interference to public safety on a long-term basis; it prevents the need to continually revisit this issue. The proposal does require congressional action. However, the benefits of such action will be significant to the public interest, especially public safety. Accordingly, Commission postponement of the 700 MHz auctions is warranted so that this proposal can be explored and implemented.

## IV. RECOMMENDED NEXT STEPS

Given the above, the Joint Commenters recommend that the FCC promptly take the following steps so that the *Coalition Proposal* can become a reality. First, the Commission should delay the 700 MHz auctions, and form a group to examine the benefits and costs associated with relocating 800 MHz public safety systems to 700 MHz. Second, the

Commission should create a special task force to coordinate efforts to eliminate interference on a case-by-case basis, making sure that best practice measures are implemented. Finally, the Commission should explore public safety-B/ILT-SMR rebanding proposals on a case-by-case and market-by market basis, *i.e.*, negotiated spectrum swaps.

## CONCLUSION

For the foregoing reasons, the Commission should adopt the rules and policies expressed herein.

Respectfully submitted,

**ALLTEL COMMUNICATIONS, INC.**

By: /s/ Glenn S. Rabin
Glenn S. Rabin
ALLTEL Communications, Inc.
601 Pennsylvania Avenue, NW
Suite 720
Washington, DC 20004
(202) 783-3976

*Its Attorney*

**CINGULAR WIRELESS LLC**

By: /s/ J. R. Carbonell
J. R. Carbonell
Carol L. Tacker
David G. Richards
Cingular Wireless LLC
5565 Glenridge Connector
Suite 1700
Atlanta, GA 30342
(404) 236-5543

*Its Attorneys*

May 6, 2002

# ATTACHMENT A

**800 MHz Interference Mitigation**
*Technical Discussion*

Prepared by:
ALLTEL Communications, Inc.
AT&T Wireless Services, Inc.
Cingular Wireless LLC
Southern LINC

## 1. Introduction

The above-named carriers formed a working group (WG) to address the technical issues related to potential interference into 800 MHz public safety radio systems.

The WG is comprised of engineers from several major cellular and digital SMR operators. In this document, we refer to 800 MHz cellular and digital SMR services collectively as the Commercial Mobile Radio Service (CMRS). The companies represent all major air interface technologies currently deployed by CMRS carriers in the 800 MHz band: CDMA, TDMA, iDEN, and analog.

The WG's tasks have included: 1. Identifying the mechanisms that are the most likely causes of interference to public safety; 2. Analyzing proposed solutions and identifying benefits and drawbacks of those solutions with regard to interference mitigation; 3. Constructing a long-term plan that the WG believes is the most effective method of reducing or eliminating public safety interference caused by 800 MHz digital SMR (primarily Nextel), and, to a much more limited extent, interference caused by cellular.

Section 2 of this document discusses the apparent causes of interference to public safety systems from CMRS operations. Section 3 summarizes available performance data for public safety portable radios. Section 4 provides summary data on performance specifications for 800 MHz CMRS transmitters. Section 5 discusses various 800 MHz reband proposals that are presented in the FCC NPRM, and provides the WG's assessment of the interference mitigation potential of each. Section 6 discusses the overall strategy that would best alleviate interference to public safety due to Nextel and, to a lesser extent, other CMRS operations.

## 2. Interference Mechanisms: Background

Each WG participant company has experienced isolated reported cases of interference into public safety systems. In each case, the reported interference was manifest as an inability of a public safety portable radio to receive communications from its associated base station. The interference occurred in a small number of well-defined geographic areas that were in the vicinity of SMR or cellular towers and were a large distance from the public safety base station tower.

In the majority of interference cases, the WG member companies have determined that the predominant contributor to the interference was Nextel.

### *2.1 Interference Factors*

The interference is the result of a combination of factors:

1. The lack of filtering within the public safety portable radios that would effectively remove CMRS transmissions from the receive path.
2. The spectrum allocations at 800 MHz that make the wide filtering of the public safety radios a necessity and that create interleaving of SMR and public safety channels.
3. The strong signal strength of the CMRS transmissions in the immediate vicinity of the CMRS towers.
4. The relatively weak signal strength of the public safety base station transmissions due to the general architecture of the public safety radio systems.

Each of these factors is discussed in greater detail in the following subsections. §2.2 discusses the root causes of the public safety interference in light of the four contributing factors.

### 2.1.1 Public Safety Portable Radio Filtering

The public safety portable radios must presently receive public safety base station signals anywhere in the 18 MHz wide frequency range of 851 – 869 MHz. Early in the receive chain of the radios (the "front end"), signals in this range must be passed with a minimum amount of loss, meaning that front-end filters must be designed to pass this range of frequencies with as little attenuation as possible. Outside of this range, the transition region between the point at which the filters provide no attenuation and the point at which they begin to provide significant attenuation (referred to as the filter roll-off) is several MHz wide. Filters that have fast roll-off are always desirable, but they are generally costly and physically large, and therefore unsuitable for portable radios.

Based on our understanding of the performance specifications of the predominant manufacturer of portable public safety radios, we generally find that the portable radios include either stripline or ceramic pre-selector filters with 3 dB bandwidths of approximately 50 MHz. Based on these general specifications, we expect the filter roll-off at the upper end of the public safety band (adjacent to the cellular base transmit band) is roughly 3 dB of attenuation over 17 MHz (-3 dB @ 886 MHz), meaning that the pre-selector filters have very little attenuation across the entire A-side cellular band at 869 – 880 MHz. Consequently, the public safety portable radios allow all of the signals from interleaved operations (for example, digital SMR) in the 851 – 869 MHz band, plus a large fraction of the signals from the cellular base transmit band, to reach the low noise amplifier, which is the first amplifier in the receive chain.

### 2.1.2 Spectrum Allocations

The wide filtering of the public safety portable radios is a result of having to operate across the entire 851 – 869 MHz band. Included in this frequency range are other allocations, namely the other Part 90 services Business, Industrial/Land Transportation, and SMR, operating on interleaved channels with public safety. Immediately above this frequency range is the base station transmitter band for the cellular A-side operators. This interleaving and adjacency produces many strong signals that are not filtered by the public safety portable radios. If public safety radios operated in their own segment of 800 MHz, with no interleaved operations, then their filters could be improved to better filter out adjacent band operations. However, due to finite filter fall-off and the economics and

size/weight constraints for portable radios, a significant guard band between public safety operations and other systems would be required. Determining the specific size of such a guard band (in MHz) would be very complex, if not impossible. The exact size required to successfully minimize interference would depend on many factors, including the architecture, power, modulation type, and geographic distribution of the adjacent operations.

#### 2.1.3 Strong CMRS Signals

CMRS operators generally operate capacity-constrained systems. To increase capacity, the operators attempt to deploy as many cells as needed, and to re-use the same frequencies on non-adjacent cells. To mitigate interference between cells, the footprint of each cell is localized as much as possible by a variety of methods, including reducing power, using antennas mounted at lower heights, and/or tilting the base station antennas downward (downtilting). This type of architecture is often referred to as "low-site low-power" design, or "cellular-like" architecture. Generally, due to the number of cells and the frequency re-use techniques, the cellular systems often have relatively strong "on-the-street" signal strengths, especially in the vicinity of the base station sites.

#### 2.1.4 Weak Public Safety Signals

In contrast to the CMRS systems, public safety systems are typically noise-limited systems. In essence, the typical public safety radio system uses as few base stations as possible, and relies on sensitive mobile and portable radios to be able to hear the base station signals out to a large distance. This architecture is sometimes referred to as "high-site, high power" design. Generally, the typical "on-the-street" signal strength from a public safety base station is significantly lower than the typical "on-the-street" signal strength of the CMRS systems.

### *2.2 Causes of Interference*

*The predominant interference mechanism is overload of the front-end amplifiers of the public safety portables.* Overload produces desensitization ("desense") and intermodulation interference ("intermod") within the public safety portable. This interference is created *inside* the portables. A third, but significantly smaller, interference contribution is CMRS out-of-band emissions that are emitted within the receive channel of the public safety portable radio.

Desense and intermod will occur whenever the public safety portable radio receives strong signals within its passband (the passband is the range of frequencies that is passed by the front-end filter). The strong signals do not have to be close in frequency to the public safety channels; they only have to be within the passband of the public safety radio. For example, even if the public safety channels are isolated to the lower portion of the 800 MHz band, and if SMR and cellular allocations were placed at the top end of the band, the public safety radios would still be affected by desense and intermod if their front-end filters remained the same as they are today. Desense will not be reduced simply by increasing the frequency separation between desired and interfering signals. New filters that take advantage of the frequency separation must be installed.

Intermod may be modestly reduced by the small amount of frequency separation that could be achieved by relocating public safety systems within the 800 MHz band, without the installation of new filters in public safety radios. This modest reduction in intermod will prove to be short-lived, though, as 800 MHz licensees continue to build out their systems, effectively reversing any improvements attained by relocation of public safety. Furthermore, the introduction of new filters in conjunction with relocating public safety systems within 800 MHz would present a trade-off for those systems. While new filters may provide additional mitigation of the intermod interference, the use of filters with higher insertion loss that further attenuate the public safety frequencies reduces the coverage provided by existing public safety systems.

Desense and intermod are related interference mechanisms, since both are created by overload of the front-end amplifier of the public safety radios. Thus, both are reduced significantly when the strength of the non-public safety signal is reduced.

Out-of-band emissions from CMRS signals are another potential source of interference to public safety communications. All transmitters produce undesired signals that are emitted outside of the intended channel of transmission. These undesired signals include: (i) spurious emissions, which are defined as harmonics and other signals that occur far removed from the intended transmit frequency, and (ii) out-of-band emissions, which by definition occur at frequencies closer to the intended transmit frequency and are a result of the modulation process. The combination of spurious and out-of-band emissions are known as unwanted emissions. Unwanted emissions that occur on public safety frequencies cannot be filtered by the public safety radios, since they are occurring on frequencies that the public safety radio is attempting to receive. Unwanted emissions can only be reduced by additional filtering on the interfering transmitter. Because out-of-band emissions are at very low power levels compared to the fundamental signal, a receiver must be very close to a CMRS transmitter before out-of-band emissions become an interference factor. At such close distances however, desense and intermod would be the predominant interference mechanisms.

## 3. Public Safety Portable Radio Performance Specifications

The following sections of this document address performance specifications and interference mechanisms in technical detail.

Limited information on the performance specifications of public safety portable radios is available to the CMRS industry. Only partial intermodulation performance specifications on some models of Motorola radios have been obtained. The data are extracted here.

*3.1 Receiver Architecture*

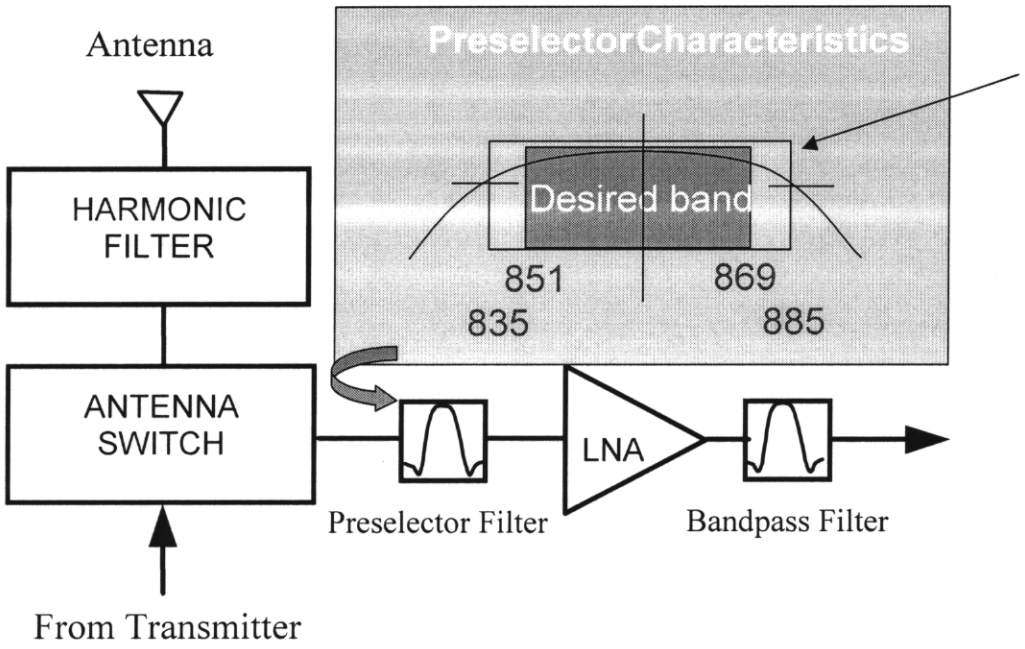


**Figure 3.1.1:** Public safety portable radio architecture (based on Motorola presentation).

Referring to Fig. 3.1.1, beginning with the antenna:

- The harmonic filter reduces the amplitude of harmonic spurious emissions transmitted by the radio.
- The antenna switch switches the antenna/harmonic filter from the receiver chain to the transmit chain when the push-to-talk button is pressed. Both the harmonic filter and antenna switch have no filtering action specific to the 800 MHz band, but do add insertion loss, which attenuates both desired and undesired signals and adds to the receiver noise figure.
- The preselector filter allows the 851 – 869 MHz band to pass, with 3 dB points at 835 and 885 MHz (50 MHz 3 dB bandwidth). It is the first band-specific filter in the receive chain. Besides filtering, it also adds insertion loss and increases the noise figure.
- The low noise amplifier (LNA) is the first amplifier in the receive chain, and is the component that plays the biggest role in desense and intermod performance. It amplifies all of the signals that pass through the preselector filter, including public safety, SMR and cellular.
- A second bandpass filter is added after the LNA, where the signal is stronger and additional insertion loss has less of an impact on receiver sensitivity.

*3.2 Preselector Filter*

The following information applies to Motorola's stripline design used in its public safety portable radios.

| | |
|---|---|
| **Poles** | 3 |
| **Insertion Loss** | 2.5 dB |
| **Bandwidth (3 dB)** | 50 MHz |
| **3 dB Points** | 835/885 MHz |
| **20 dB Points** | Not Provided |
| **Approximate Q ( $f_0/\Delta f_{3dB}$ )** | 17.2 |
| **Package Dimensions** | 440 x 415 x 80 mil |

**Table 3.2.1:** Motorola public safety portable radio preselector filter specifications

*3.3 Desense/Low Noise Amplifier*

The effect of desense is quantized by its impact on the amplifer's power budget. In essence, when a strong signal is introduced into the LNA, the LNA uses most of its available power to amplify the stronger signal. When the input signal exceeds a certain level, there is insufficent power available to produce a proportionately amplified output, an effect called gain compression. The LNA performance is usually specified by the 1 dB gain compression point, which is the input signal level at which output signals are reduced in power by 1 dB relative to the expected level. For example, for an amplifier with a nominal 10 dB gain, the 1 dB compression point would be the input signal level for which the achieved gain of the amplifier is only 9 dB due to power budget limitations. No gain compression figures were available to the WG for public safety portable radios.

*3.4 Intermodulation Performance/Low Noise Amplifier*

The intermodulation (IM) performance is characterized by the IM ratio (*IMR*). The 3$^{rd}$-order intermod power equals the noise floor when the input interference power is at a level of *IMR* dB above the reference sensitivity $I_{ref}$. For example, the Motorola specifications state an *IMR* of 73 dB and a reference sensitivity of –119 dBm for a 12 dB SINAD, so that the output 3$^{rd}$-order IM power reaches a level of –123 dBm (the receiver noise floor) when the interference is at a level of –46 dBm.

| | |
|---|---|
| **Input 3$^{rd}$-order Intercept ($IIP_3$)** | 3 dBm |
| **Reference Sensitivity ($I_{ref}$)** | -119 dBm (12 dB SINAD) |
| **IM Ratio (IMR)** | 73 dB |
| **Noise Floor** | -123 dBm |

**Table 3.3.1:** Motorola public safety radio intermod performance.

## 4. CMRS Base Station Transmitter Out-of-Band Emission Specifications

Cellular and SMR base stations are required to meet or exceed the following out-of-band emissions performance specifications:

| | | |
|---|---|---|
| **SMR** | -80 dBc or -13 dBm per 25 kHz*, whichever is the lesser attenuation | 47 C.F.R. § 90.669 |
| **Cellular** | -60 dBc or -13 dBm per 30 kHz*, whichever is the lesser attenuation | 47 C.F.R. § 22.917 |

* The FCC rules do not specify the measurement bandwidth; it is assumed equal to the allotted channel bandwidth

**Table 4.1:** Out-of-band emission limits for SMR and cellular base stations.

Out-of-band emissions generally fall off with frequency separation. Because of this, transmitters that are closer in frequency to public safety (for example, the interleaved Nextel channels) are a much larger contributor to out-of-band emissions that are received in the public safety radios. Cellular transmitters, which are farther removed in frequency from public safety and are not interleaved with public safety, are a much smaller source of out-of-band emissions interference than Nextel.

## 5. Proposals for Re-Banding the 851 – 869 MHz Band

Multiple proposals for rebanding the 800 MHz band have been proposed by various entities. Each plan should have as the primary goal reducing interference to public safety radio systems due to CMRS operations.

This section sets forth a framework for analyzing each proposal in the FCC's *Notice of Proposed Rulemaking* (and others that may be proposed) for impact on public safety interference in light of the public safety radio performance specifications and known interference mechanisms discussed in §§2 – 4.

### *5.1 Interference Mitigation Factors*

#### 5.1.1 Receiver Overload

Each reband proposal is discussed with respect to reducing receiver desense. The only method of reducing desense is to move the interfering signals outside of the passband of the public safety radio's preselector filter. *Moving the public safety frequency allocation and the interfering frequency allocation farther apart spectrally, without moving the interfering frequency allocation outside of the public safety radio passband, will have no effect on reducing desense.* For purposes of this analysis, it is assumed that existing public safety radios will continue to be used.

#### 5.1.2 Intermodulation

The intermodulation performance of each rebanding proposal is analyzed in terms of the likelihood that intermodulation products from the CMRS services will fall within the rebanded public safety frequency allocation. The analysis takes into consideration whether the intermodulation products are produced by a single CMRS interferer (for example, SMR), or whether the products are produced by a mix of two CMRS interferers (for example, SMR mixing with A-side cellular). The supposition is that intermodulation

interference that is caused by a single party is easier to rectify and coordinate than intermodulation interference that must be reconciled among two or more possibly competing parties. Only third-order mixing products between two carrier frequencies are considered.

5.1.3 Out-of-Band Emissions

The rebanding proposals are judged upon the relative impact of out-of-band emissions from CMRS carriers on interference into public safety. Since out-of-band emissions fall off rapidly with frequency separation, greater frequency separation between public safety and CMRS will improve out-of-band emissions interference. Generally, if a public safety portable is sufficiently close to receive significant out-of-band emissions from a CMRS transmitter, desense will be the larger problem.

5.1.4 Disruption, Time to Implement, and Cost

This criterion considers factors that would influence how difficult, costly, and time-consuming each rebanding proposal would be. Included in the factors are the impacts of relocation, new equipment purchases, and the potential loss of customers or services.

*5.2 Baseline Allocation*

The present allocation is used as a baseline.

- Desense: The interleaved channel allocations between public safety and SMR providers, combined with the immediate adjacency of the public safety allocation with cellular A block, make overload a certainty with the present allocation and public safety filter specs of which we are aware.
- Intermod: The present allocation, with public safety channels dispersed throughout the 851 – 869 MHz band, allows intermod products from and between multiple services to potentially interfere with public safety channels.
- Out-of-band emissions: Some public safety channels (the NPSPAC channels) are immediately adjacent to the cellular allocation. Others are immediately adjacent to SMR allotments. The adjacencies create allow higher levels of out-of-band emission interference than would occur if the public safety channels are moved farther away from CMRS. Out-of-band emission interference is not a significant contributor to the interference problem, however.
- Disruption: Since no rebanding is applicable, no disruption or cost associated with rebanding is created.

*5.3 Nextel Proposal*

Under the *Nextel Proposal,* two separate but adjacent contiguous channel blocks would be created in the 800 MHz band. The upper 16 MHz block would be reserved for digital SMR at 816-824 MHz and 861-869 MHz. The lower 20 MHz block at 806-816 MHz and 851-861 MHz would be reserved for public safety, although the need for a guard band on the downlink between digital SMR and public safety may reduce the proposed block to 18 MHz or less. Many 800 MHz B/ILT incumbents would be relocated to 700 or 900 MHz bands.

- Desense: Without new public safety filters, moving the public safety allocation to the lower portion of the band will have no effect on desense. Consequently, desense will continue as one of the two predominant sources of interference.
- Intermodulation: Compared to the present allocation, somewhat fewer intermod products will fall in the Nextel public safety allocation. However, the combination of a lack of filtering in the public safety radios, together with the large number of interfering CMRS signals, will still result in a significant number of intermod products falling in the 851 – 861 MHz public safety block.
- Out-of-band emissions: The Nextel plans move public safety away from cellular A block, but it is still immediately adjacent to the low-site digital SMR allocation at 861 – 869 MHz, although possibly separated by a guard band of unknown extent.
- Disruption: The Nextel plan requires massive relocations, requiring new equipment to relocate B/ILT users to 900 and 700 MHz. The 700 MHz equipment is not even commercially available at this time.

*5.4 FCC*

Under the FCC's proposal, lower 800 MHz public safety licensees in the interleaved bands would be moved to contiguous spectrum at 809.75-811.5 MHz and 854.75-856.5 MHz. They would operate next to B/ILT licensees at 811.5-814 MHz and 856.6-859 MHz, which would provide a buffer from interfering digital SMR systems. However, the current upper 800 MHz public safety allocation at 821-824 MHz and 866-869 MHz would remain unchanged and adjacent to potentially interfering digital SMR at 816-821 MHz and 861-866 MHz.

- Desense: Without new public safety filters, CMRS operations still remain within the public safety radio passband. With public safety channels at both the low end and the high end of the band, even future generation public safety radios would not be able to take advantage of improved filtering, since both ends of the bands still need to be passed.
- Intermodulation: With the NPSPAC allocation remaining the same, there will be no reduction of intermod within these channels. Aggregating the other public safety channels to the low end of the band may result in a slight reduction in intermod interference there. With public safety channels at both the low end and the high end of the band, even future generation public safety radios would not be able to take advantage of improved filtering, since both ends of the bands still need to be passed.
- Out-of-band emissions: The new aggregated public safety channels at the low end would experience a reduction in out-of-band interference. The NPSPAC channels, which remain the same as today, would see no improvement.
- Disruption: The FCC plan requires a smaller number of retunes and frequency swaps than the Nextel or NAM proposals.

*5.5 NAM*

Under the NAM Proposal, three separate but adjacent contiguous channel blocks would be reserved as follows: (i) 10 MHz for public safety at 806-811 MHz and 851-856 MHz; (ii) 10 MHz for conventional SMR and B/ILT at 811-816 MHz and 856-861 MHz; and (iii) 16 MHz for digital SMR (i.e., Nextel) at 816-824 MHz and 861-869 MHz.

- Desense: Without new public safety filters, CMRS operations still remain within the public safety radio passband. Consequently, the NAM proposal will not alleviate desense.
- Intermodulation: Compared to the present allocation, somewhat fewer intermod products will fall in the NAM public safety allocation. However, the combination of a lack of filtering in the public safety radios, together with the large number of interfering Nextel signals, and to a lesser extent other CMRS signals, will still result in a significant number of intermod products still falling in the new public safety block.
- Out-of-band emissions: The new public safety block is removed from both the cellular and SMR bands. Lower out-of-band emissions will be present in the new public safety allocation, although these emissions are only a small contributor to the interference problem.
- Disruption: NAM requires significant relocations and new equipment, but does not require relocations to new bands.

**6. Summary and Recommendations**

This document summarizes the experiences of the WG with regard to reported public safety interference. It provides a summary of technical data related to interference. It also discusses the various 800 MHz rebanding proposals, and their predicted impact on reducing interference.

The discussions and technical data presented in this document lead to the clear conclusion that, by itself, *rebanding 800 MHz will not produce any significant reduction in interference to public safety communications.* Rebanding 800 MHz will only result in reduced interference if the manufacturers of public safety radios redesign their systems to take specific advantage of the new allocations. It is the WG's understanding that the lifespan of public safety radios is typically 15 years or more, requiring until 2017 or beyond before public safety will be able to take advantage of new radio technology. Even with new hardware, public safety radios will continue to have trouble operating in the 800 MHz band, as other 800 MHz operators build out their systems and compete for valuable spectrum. Further, by creating radios that are specific to the new allocation, the public safety radio performance may suffer for other reasons (higher filter insertion loss), and public safety will have no ability to expand spectrum capacity in the future.

For all of these reasons, it is the conclusion of the WG that the only clear path to mitigation of interference is to relocate public safety to a new band entirely. For several reasons, the upper 700 MHz band is ideal:

- A public safety allocation already exists at 700 MHz.

- Additional upper 700 MHz spectrum (30 MHz that has yet to be auctioned) is available for possible reallocation to public safety, providing them with room for future expansion of spectrum capacity.
- Current incumbents in 700 MHz, not yet in operation, are limited to the "Guard Band" licensees, which are not allowed to operate cellular-like systems and which have very tight out-of-band emissions limits already in place.
- The timescale for availability of 700 MHz spectrum (end of 2006) is over ten years sooner than awaiting for general penetration of new "rebanded" 800 MHz radios.
- Auction of current 800 MHz public safety spectrum could provide expansion spectrum for 800 MHz incumbents such as Business, Industrial/Land Transportation, SMR, and cellular, and the revenues from the auction could be used to relocate public safety to 700 MHz.

Although the WG believes that, in the long term, relocation of public safety to 700 MHz is the only option that will substantially reduce public safety interference, in the near-term it urges public safety, Nextel, and the WG member companies to continue to follow the APCO "Best Practices Guide" when performing system engineering and when dealing with cases of reported interference to public safety systems.

**ATTACHMENT B**

April 26, 2002

The Honorable Michael K. Powell
Chairman
Federal Communications Commission
445 12th Street, S.W., Room 8-B201
Washington, D.C. 20554

**Re: Delay of Auction Nos. 31 and 44 Scheduled for June 19, 2002**
**WT Docket No. 99-168, GN Docket No. 01-74**

Dear Mr. Chairman:

The Coalition for Constructive Public Safety Interference Solutions ("Coalition") is comprised of organizations which collectively represent the interests of both small and large commercial mobile radio service providers, manufacturing, and Private Radio enterprises in spectrum-related matters before the FCC. The Coalition submits this letter in support of CTIA's request, filed April 24, 2002, seeking full Commission review of its request to delay the 700 MHz auctions-- **Auction Nos. 31 and 44.**

As you are aware, the Commission is currently undertaking a rulemaking proceeding that has as its primary goal improving Public Safety communications in the 800 MHz band and eliminating the interference currently being experienced by some Public Safety entities. A number of proposals currently under discussion involve re-tuning or re-banding the 800 MHz spectrum. The Coalition notes that while these proposals would help mitigate some interference to Public Safety, none of them would eliminate the interference. As such, the Coalition has developed a plan that would relocate Public Safety from the 800 MHz band to the 700 MHz band and reallocate some 700 MHz spectrum currently specified for commercial usage to Public Safety (but excluding the guard bands which have already been auctioned). In addition to solving interference to Public Safety and providing Public Safety with more spectrum than it currently has, the plan also provides options for Homeland Security uses not available under other proposals. The general overview of this plan is attached.

The Coalition acknowledges that any relocation of public safety to the 700 MHz band designated for commercial use will require legislative action. While it is premature to assume that the necessary statutory changes will be enacted into law, it is equally premature to eliminate the Coalition's proposal from consideration by going forward with the auctions on the scheduled date. A delay in the auction would allow this proposal to be discussed thoroughly with Congress and the Administration as well as other interested parties, enabling a spectrum management policy that is focused on long-term public interest and Public Safety needs.

In view of the above, the Coalition respectfully requests that the Commission delay the start of Auction Nos. 31 and 44 beyond the currently scheduled date of June 19, 2002.

Sincerely,

/s

/s/

Terry Addington
President & CEO
FIRSTCellular
417 S. 42nd Street
Mt. Vernon, IL 62864

/s/

Leo R. Fitzsimon
Director, Regulatory & Industry Affairs
Nokia Inc.
1101 Connecticut Avenue, NW
Suite 910
Washington, DC 20036

/s/

Douglas I. Brandon
V.P., External Affairs & Law
AT&T Wireless
1150 Connecticut Avenue, NW
4th Floor
Washington, DC 20036

/s/

Michael Rosenthal
Director, Regulatory Affairs
Southern LINC
5555 Glenridge Connector
Suite 500
Atlanta, GA 30341

/s/

Brian F. Fontes
V.P., Federal Relations
Cingular Wireless
1818 N Street, NW
Suite 800
Washington, DC 20036

/s/

Glenn Rabin
V.P., Federal Regulatory Affairs
Alltel Corporation
601 Pennsylvania Avenue, NW
Suite 720
Washington, DC 20004

Attachment

# A Concept Paper to Address Public Safety Interference in the 800 MHz Band

# Relocate Public Safety to Upper 700 MHz Band

- Give all of the upper 700 MHz band (channels 60-69) to Public Safety (includes Public Safety and commercial wireless spectrum ⇨ 54 MHz).
- Some spectrum can be used for Homeland Security, PAS and/or critical infrastructure.
- Move 800 MHz Public Safety to 700 MHz
- Auction vacated 800 MHz Public Safety spectrum.
- Use auction revenues to help relocate Public Safety to 700 MHz.
- Broadcasters must exit upper 700 MHz band by 12/31/06 or sooner.

# Major Advantages Over Nextel Proposal

- **Resolves** interference issues with public safety.
- Increases Public Safety spectrum from current 33.5 MHz to 54 MHz (Nextel proposal would increase Public Safety spectrum to 44 MHz); coincidental switch to digital technology, such as APCO 25, will further increase effective spectrum capacity and services.
- 800 MHz commercial incumbents could gain access to additional spectrum through auction.
- Auction revenues goes toward helping relocate Public Safety.

# Benefits to Public Safety

- **Resolves** interference issues.
- Gain access to 30 MHz of additional spectrum nationwide (20.5 MHz net).
- Date certain for access to 700 MHz band.
- Auction proceeds helps pay for relocation and upgrades.
- Facilitates Public Safety interoperability, priority access services and other Homeland Security needs.

# Benefits to B/ILT, SMR, Energy, Water and Railroad Spectrum Licensees

- No licensee relocation or associated relocation costs.
- Ability to participate in auction. Gain access to additional spectrum contiguous to current licenses.

# Benefits to Nextel

- **Eliminates** interference with public safety.
- Reduces relocation costs.
- Can participate in auction gaining access to additional spectrum.

# Benefits to CMRS (Cellular) Licensees

- Can participate in the auction to gain access to additional spectrum contiguous to current cellular licenses.

# Proposal

- Step One - Postpone 700 MHz auction while proposal is being examined as part of the NPRM related to Public Safety Interference.

# Proposal

- Step two - develop legislation to:
  - Delay the 700 MHz auction, consistent with President Bush's FY '03 budget.
  - Allocate entire upper 700 MHz band to Public Safety with the exception of the guard bands.
  - Re-allocate 800 MHz band vacated by Public Safety and set it for auction.
  - Target revenues from auction for relocating Public Safety to 700 MHz.
  - Explore alternative funding arrangements for Public Safety's telecommunications needs today and into the future.
  - Set a definitive timeframe for broadcasters to vacate upper 700 MHz band - **12/31/06 or sooner.**

# Comparison to Nextel Proposal

## Nextel Proposal

- Does not resolve interference issue
- Significant relocation costs for Public Safety, B/ILT, and SMR licensees
- Long time frame for implementation
- Public Safety gets 10 MHz additional spectrum
- Does not facilitate Homeland Security, Public Safety interoperability, or PAS.
- Spectrum Windfall for Nextel

## Alternative Proposal

- Resolves interference issues
- Auction Revenues help pay for relocation costs of Public Safety
- Shorter time-frame for implementation
- Public Safety gets 20.5 MHz additional spectrum
- Facilitates Homeland Security, Public Safety interoperability and PAS.
- No spectrum windfall for 800 MHz incumbents